

REMARKS

Claims 1-12 are pending in this application. Claims 1-9 stand rejected as being obvious over Setzer et al '746; and Claims 10-12 were rejected as being obvious over Setzer et al '746 in view of Jackson et al. The independent claims, save Claim 12, have all been amended to recite the 300°F to 450°F operating range which is disclosed in the application and claimed in Claim 12. Both of the rejections thus rely on the Setzer et al reference.

Claims 1-9 have also been made the subject of provisional double patenting rejections based on U.S. Patents Nos. 6,533,924 and 6,454,935. Claims 1-12 have been made the subject of a provisional double patenting rejection based on claims 1, 2 and 4-11 of co-pending patent application serial number 10/042,056. These rejections will be addressed separately below.

THE PROVISIONAL DOUBLE PATENTING REJECTIONS:

Three terminal disclaimers are submitted herewith which are operative to render these rejections moot. Two copies of a cover letter relating to these terminal disclaimers are also enclosed herewith.

THE §103 REJECTIONS:

- a) Claims 1-9 stand rejected as being obvious over Setzer et al. This rejection is based solely on the Setzer et al reference.

In Setzer et al, the desulfurization process is carried out at temperatures in the range of about 500° to 900°F (Col. 3, line 2); and the desulfurized fuel must have a sulfur content of less than about 20 ppm (Col. 3, line 16), since a sulfur content in the desulfurizer bed which is above that level indicates that the bed is not functioning properly.

As noted on page 6 of the office action, there are "Several differences" between the applicants' claimed invention and the contents of the Setzer et al reference.

With respect to Claims 1-9, a major difference between Setzer et al and the subject matter of Claims 1-9, which is conceded by the Examiner, is the allowable sulfur content of the desulfurizing bed effluent, which in Setzer et al is anything under 20 ppm and in the instant application is anything less than 0.05 ppm. Stated another way, in Setzer et al, any sulfur content over 20 ppm (breakthrough) in the effluent is not acceptable; while in the instant case, any sulfur content over 0.05 ppm (breakthrough) is not acceptable. Thus the breakthrough sulfur concentration in the Setzer et al reference is 400 times the breakthrough

sulfur concentration in the instant case.

The Examiner deals with this fact by simply stating that: "Since the modified process of Setzer (et al) is similar to the claimed process in terms of feed stock, reactant and oxygenate, it would be expected that the product of Setzer (et al) would have less than 0.5 ppm sulfur as claimed."

There are several serious problems with the Examiner's aforesaid position statement.

First of all, what does the Examiner mean by "the modified process of Setzer"? This is a single reference §103 rejection, which is based solely on Setzer et al. The reference can't modify itself, and the Examiner cannot use Applicants' own teachings to modify the reference. Where does the alleged modification of the prior art process come from? Please explain.

Secondly, Claims 1-12 do not recite breakthrough concentrations of sulfur that are above 0.5 ppm sulfur. The breakthrough concentration in all of the claims in this application is 0.05 ppm sulfur.

On page 8 of the office action, the Examiner states that: "the modification of Setzer (et al) (again, **WHAT MODIFICATION OF SETZER?**) is similar to the claimed process in terms of feedstock, reactant and oxygenate. It would be expected that the product of Setzer (et al) would have less than 0.5 (0.05) ppm sulfur as claimed.". With all due respect, the Examiner's argument is what is "not persuasive", since the fact of the matter is that it would be expected that the product of Setzer et al would be less than 20 ppm sulfur, as Setzer et al clearly points out. The Examiner seems to be confusing the meaning of "would be expected" and "could be expected" here.

All of the claims in this application now recite the 300°F to 450°F temperature operating range. A 500°F to 900°F temperature operating range is the only temperature operating range disclosed in Setzer et al '746. We submit that 500°F is not close enough to 450°F to suggest that the Setzer et al desulfurizer should be operated at the lower temperature.

It is elementary from Setzer et al that postponement of breakthrough is most desirable. FIG. 2 in Setzer et al clearly shows the relationship between the time to reach breakthrough (in hours) and the operating temperature (in degrees F) of the desulfurizing bed. FIG. 2 indicates that breakthrough will occur after about 9 hours from start up at an operating temperature of 500°F, and the longest breakthrough time (about 16 hours) will occur at an

operating temperature of about 600°F. Thus, Setzer et al suggests that the higher operating temperature of 600°F would be twice as desirable as the lowest operating temperature of 500°F.

The Examiner's arguments regarding the respective operating temperature ranges set forth in the claims in this application and in the Setzer et al are set forth in summary in lines 1-4 on page 8 of the office action. There, the Examiner states that one of ordinary skill would be motivated to select a specific elevated temperature which accomplishes a desired level of desulfurization, such as the specific temperature (range) claimed by Applicants "because it would be expected that the results would be the same or similar when operating the process of Setzer et al +++ at either 500 or 450°F."

We take that to mean that the Examiner thinks that one skilled in the art would be motivated by Setzer et al to operate the desulfurization process of Setzer et al at a low temperature (450°F) which would produce less than an 8 hour breakthrough time period, when Setzer et al clearly suggests that the higher operating range temperatures (500°-900°F) will produce greater than an 8 hour breakthrough time period.

Obviousness cannot be established by modifying the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the modification. Under 35 USC 103, teachings of references can be combined only if there some suggestion or incentive to do so. The motivation to combine or modify must be found in the prior art. The application being examined cannot be used as a template to piece together the teachings of the prior art so that the claimed invention is rendered obvious. See: In re Gordon, 221 USPQ 1125 (Fed. Cir. 1988); In re Fine, 5 USPQ2d 1596 (Fed. Cir. 1988); and In re Fritch, 23 USPQ2d 1780 (Fed. Cir. 1992).

Page 9 of the office action contains the following statement from the Examiner which he or she puts forth in an effort to point out why one skilled in the art would be motivated by Setzer et al to operate the Setzer et al process at lower temperatures than are suggested by Setzer et al. "The argument that it is not obvious (correction: 'would not have been obvious') to modify the process of Setzer et al at a temperature of from 300 to 450°C (**with all due respect, it's degrees Fahrenheit, not Centigrade.**) is not persuasive. From FIG. 2, one would learn that the process of Setzer et al would be operable at a low temperature such as 450°C (No, °F) and at such temperature it would be expected that the breakthrough time would be less. This may result in more frequent catalyst regenerating. However, operating at lower temperature would not effect the overall

removal of sulfur in the process.

The Examiner has essentially alleged that the upper end of the claimed temperature range (450°F) is close enough to the lower end of the prior art temperature range (500°F) so that one of ordinary skill in the art would be motivated by Setzer et al, or would believe that the claimed 450°F temperature would be desirable to use in the performance of the prior art Setzer et al procedure. We interpret the Examiner's position as alleging that the use of a 450°F operating temperature in the Setzer et al '745 procedure would be desirable and should be used. Looking at FIG. 2 of Setzer et al '745 we note that the graph indicates that there is a linear decrement in the breakthrough time between the operating temperatures of 600°F and 900°F, and that the use of temperatures which are equal to or greater than 600°F are more desirable than the lowest operating temperature of 500°F.

Operating temperatures below 500°F, if extrapolated from FIG. 2, would provide a breakthrough time which declines logarithmically, and which would be at zero hours before or at reaching an operating temperature of 450°F. On page 9 of the office action, the Examiner disputes this fact and states that: "it is extrapolated that the breakthrough time would be about 4 hours.". **This is incorrect.** Enclosed, for the record, is a copy of FIG. 2 of Setzer et al with the breakthrough time curve continued (as highlighted) past the 500°F temperature line. The continued time curve clearly shows that the breakthrough time at 450°F would be about zero hours, not four hours. The Examiner further alleges on page 9 of the office action that: "it would be expected that the results would be the same or similar when operating the process of Setzer (et al) at either 500 or 450°F.". Setzer et al itself clearly shows that operating its desulfurization process at 500 or 450°F would not produce the same or similar results.

The only correlation between operating temperatures and the achievement of the undesirable breakthrough shown in Setzer et al '745 is shown in FIG. 2 and indicates that it would not be desirable to utilize an operating temperature which is below 500°F, and certainly not one which is as low as 450°F. Setzer et al '745 thus does not suggest that an operating temperature of less than 500°F would be desirable.

We submit, that one of skill in any art would never be motivated by a single reference to modify that reference so as to decrease its effectiveness, and would certainly never be motivated to modify that reference's teachings so as to render the subject matter put forth in

that reference inoperative. To suggest otherwise, as the Examiner is doing here, is, with all due respect, ridiculous.

Regarding Claims 11 and 12, these claims both require that the oxygenate be converted to another compound by the nickel reactant bed. Neither Setzer et al nor Jackson et al suggest the desirability of using a nickel reactant bed to convert an oxygenate to another compound of the types recited in these claims. Regarding the teachings of Jackson, the Examiner notes that Jackson suggests that gasoline should include organic oxygenates which are known to increase the octane value of a base fuel. This being the case, Jackson requires that the original oxygenate which is mixed in with the base fuel be present in the fuel when the fuel is combusted. If one were to expose the base fuel-oxygenate mixtures proposed by Jackson to the methods described in Claims 11 and 12, the result would be a conversion of the oxygenates in Jackson to different compounds, thus the oxygenates would no longer be present in the base fuel at combustion, and the benefits described by Jackson which are derived from the oxygenates during combustion of the base fuel would be lost. One skilled in the art would not be motivated to subject the base fuel mixture of Jackson to a process wherein the benefits of having an oxygenate in the fuel mixture would be lost. Thus, it would not be obvious to utilize the fuel mixtures described in Jackson in performing the process described in Setzer et al.

In view of the amendments to the claims in this application, the accompanying terminal disclaimers, and the arguments advanced above, it is respectfully submitted that this application is presently in condition for allowance. Early notice to that effect is courteously requested.

Respectfully submitted,

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Listing of Claims.

- 1.(currently amended) A method for desulfurizing a hydrocarbon fuel stream so as to convert the hydrocarbon fuel stream into a low sulfur content fuel, which low sulfur content fuel is suitable for use in an internal combustion engine, said method comprising the steps of:
 - a) providing a nickel reactant desulfurization station which is operative to convert sulfur contained in organic sulfur compounds contained in the fuel stream to nickel sulfide;
 - b) maintaining said nickel reactant desulfurization station at a temperature in the range of about 300°F to about 450°F;
 - b) c) introducing a hydrocarbon fuel stream which contains an oxygenate into said nickel reactant desulfurization station; and
 - c) d) said oxygenate being present in said fuel stream in an amount which is effective to provide an effluent fuel stream at an exit end of said nickel reactant station which effluent fuel stream contains no more than about 0.05 ppm by weight sulfur.
- 2.(original) The method of Claim 1 wherein the oxygenate is selected from the group consisting of water, alcohol, ether, and mixtures thereof.
- 3.(original) The method of Claim 2 wherein the oxygenate is selected from the group consisting of water, MTBE, ethanol, methanol, and mixtures thereof.
- 4.(original) The method of Claim 1 wherein said hydrocarbon fuel is gasoline.
- 5.(original) The method of Claim 1 wherein said hydrocarbon fuel is diesel fuel.
- 6.(currently amended) A method for desulfurizing a gasoline or diesel fuel stream so as to convert the gasoline fuel stream into a low sulfur content fuel, which low sulfur content fuel is suitable for use in an internal combustion engine, said method comprising the steps of:
 - a) providing a nickel reactant desulfurization station which is operative to convert sulfur contained in organic sulfur compounds contained in the fuel stream to nickel sulfide;
 - b) maintaining said nickel reactant desulfurization station at a temperature in the range of about 300°F to about 450°F;
 - b) c) introducing a gasoline or diesel fuel stream which contains an oxygenate into said nickel reactant desulfurization station; and
 - c) d) said oxygenate being present in said fuel stream in an amount which is effective to provide an effluent fuel stream at an exit end of said nickel reactant station which effluent fuel stream contains no more than about 0.05 ppm by weight sulfur.

7.(original) The method of Claim 5 wherein the oxygenate is selected from the group consisting or water, alcohol, ether, and mixtures thereof.

8.(original) The method of Claim 7 wherein the oxygenate is selected from the group consisting of water, MTBE, ethanol, methanol, and mixtures thereof.

9.(currently amended) A method for desulfurizing a gasoline or diesel fuel stream so as to convert the fuel stream into a low sulfur content fuel, which low sulfur content fuel is suitable for use in an internal combustion engine, said method comprising the steps of:

- a) providing a nickel reactant desulfurization station which is operative to convert sulfur contained in organic sulfur compounds contained in the fuel stream to nickel sulfide;
- b) maintaining said nickel reactant desulfurization station at a temperature in the range of about 300°F to about 450°F;
- b) c) introducing a gasoline or diesel fuel stream which contains an oxygenate into said nickel reactant desulfurization station; and
- c) d) said oxygenate being present in said fuel stream in an amount which is effective to provide a continuous fuel stream at an exit end of said nickel reactant station which continuous fuel stream contains on average no more than about 0.05 ppm by weight sulfur.

10.(currently amended) A method for desulfurizing a gasoline or diesel fuel stream so as to convert the fuel stream into a low sulfur content fuel, which low sulfur content fuel is suitable for use in an internal combustion engine, said method comprising the steps of:

- a) providing a nickel reactant desulfurization station which is operative to convert sulfur contained in organic sulfur compounds contained in the fuel stream to nickel sulfide;
- b) maintaining said nickel reactant desulfurization station at a temperature in the range of about 300°F to about 450°F;
- b) c) introducing a gasoline or diesel fuel stream which contains an oxygenate into said nickel reactant desulfurization station; and
- c) d) said oxygenate being converted to isobutylene and methanol by said nickel catalyst in amounts which are effective to inhibit carbon deposition in said nickel catalyst station and provide a continuous fuel stream at an exit end of said nickel reactant station which continuous fuel stream contains no more than about 0.05 ppm by weight sulfur.

11.(currently amended) A method for desulfurizing a gasoline or diesel fuel stream so as to convert the fuel stream into a low sulfur content fuel, which low sulfur content fuel is suitable for use in an internal combustion engine, said method comprising the steps of:

- a) providing a nickel reactant desulfurization station which is operative to convert sulfur

- contained in organic sulfur compounds contained in the fuel stream to nickel sulfide;
- b) maintaining said nickel reactant desulfurization station at a temperature in the range of about 300°F to about 450°F;
- b) c) introducing a gasoline or diesel fuel stream which contains an oxygenate into said nickel reactant desulfurization station, said oxygenate being present in said fuel stream in an amount which is effective to provide a low sulfur content fuel stream at an exit end of said nickel catalyst station which low sulfur content fuel stream contains no more than about 0.05 ppm by weight sulfur; and
- c) d) said oxygenate being converted to isobutylene and methanol by said nickel reactant during said desulfurizing step, said low sulfur content fuel stream being formed so long as said nickel reactant continues to convert the oxygenate.

- 12.(original) A method for desulfurizing a liquid gasoline or diesel fuel stream so as to convert the fuel stream into a low sulfur content fuel, which low sulfur content fuel is suitable for use in an internal combustion engine, said method comprising the steps of:
- a) providing a nickel reactant desulfurization station which is operative to convert sulfur contained in organic sulfur compounds contained in the fuel stream to nickel sulfide;
- b) maintaining said nickel reactant desulfurization station at a temperature in the range of about 300°F to about 450°F;
- c) introducing a liquid gasoline or diesel fuel stream which contains an oxygenate into said nickel reactant desulfurization station, said oxygenate being present in said fuel stream in an amount which is effective to provide a low sulfur content fuel stream at an exit end of said nickel reactant station which low sulfur content fuel stream contains no more than about 0.05 ppm by weight sulfur; and
- d) said oxygenate being converted to isobutylene and methanol by said nickel reactant during said desulfurizing step, said low sulfur content fuel stream being formed so long as said nickel reactant continues to convert the oxygenate.



Ex, A

Dec. 23, 1969

H. J. SETZER ET AL

3,485,746

SULFUR REMOVAL FROM HYDROCARBONS

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3 Sheets-Sheet 1

FIG. 1

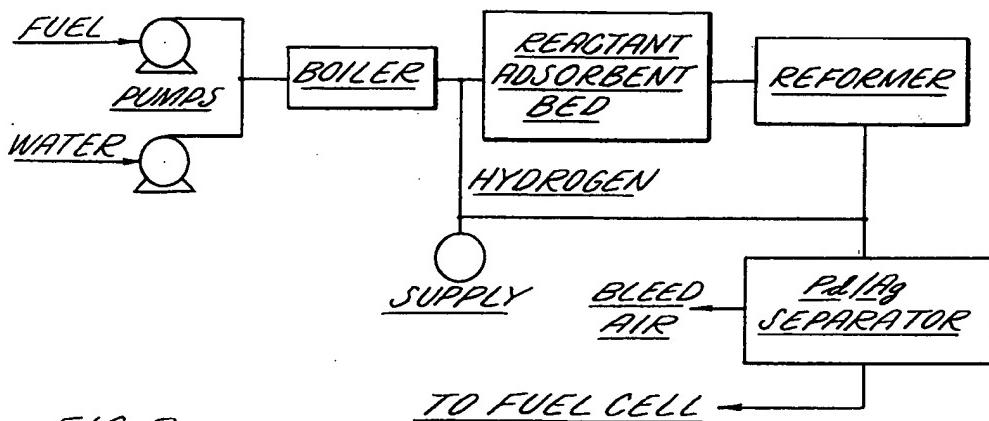
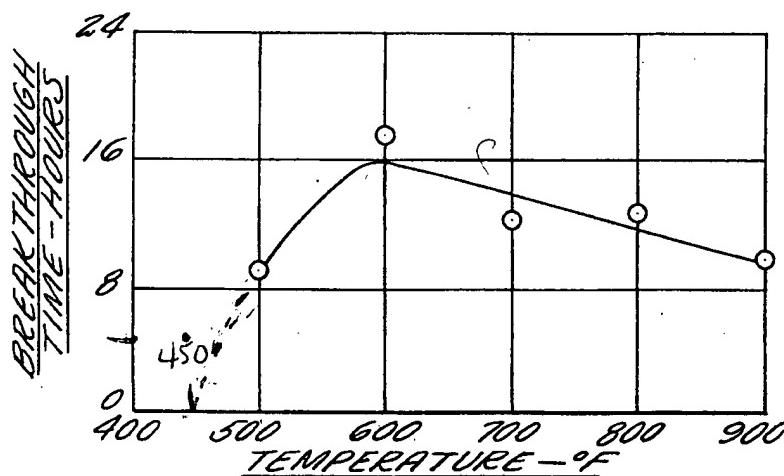


FIG. 2

FUEL: JP-4 DOPOED WITH THIOPHENE TO 419 PPM SULFUR
WHSV (FUEL ONLY): 1.575 PRESSURE: 250 PSIG
H₂O/C : 3.5 MOLES/MOLE REACTANT-ADSORBENT: 6-498
H₂/FUEL: 0.028 LB/LB.



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